

Remarks

Claims 1-3, 6-24, 26-30, 33-51, 53-60 remain in the application. Claims 1-3, 6-9, 14, 15, 23, 24, 27-30, 34-36, 41, 42, 51, 54 and 60 were amended herein. The amendments add no new matter and are fully supported by the original claims, the specification and figures. Claims 4, 5, 25, 31, 32, and 52 were canceled herein.

Applicants are grateful that the Examiner acknowledged that claims 10-14, 37-41 and 55-60 are directed to allowable subject matter. (Claims 14, 41 and 60 were amended to make them dependent for no other reason except to reduce the number of independent claims in the application.)

Claims 1-4, 7-9, 15-22, 24-31, 33, 34, 37, 38, 42, 43 45-49 and 51 were rejected under 35 USC §102(b) as being anticipated by Hong (WO99-60079). The Office Action states:

"Hong discloses a machining process which sprays liquid cryogen on the intersection of the workpiece and the tool. This is disclosed to make the workpiece harder in line 23 of column 2. Since Hong's method is the same as applicant's claimed method, the workpieces are seen to have the same properties. This is especially true for claims 16-22 which are product by process claims. Since the process of Hong is the same as applicant's, the products produced thereby are seen as having the same properties."

Hong does not disclose Applicants' inventions as claimed, and is not a proper §102 reference. Hong does not disclose Applicants' claimed impingement angle and spread angle. Hong did not disclose that the application of cryogenic fluid onto the tool and onto the workpiece improves the surface finish or surface integrity or both of the workpiece. Hong actually teaches away from the present invention. At page 9 (line 25), Hong states: "Due to extremely low temperature of the liquid nitrogen, its direct contact with the workpiece would make the materials to become harder, making them more difficult to be machined. Thus transfer tubes 160 should be mounted on the tool so that the liquid nitrogen is only injected to the cutting edges of the tool and not onto the workpiece." Also, at page 2, line 23, Hong states: (I believe this is what the Office Action refers to by "line 23 of column 2.") "Although the success of cryogenic machining was reported...the technology was abandoned in the 1970s due to the high costs associated with early cryogenic technology and since some materials become harder under cryogenic temperatures, making them more difficult to be

machined.” That too is a teaching away by Hong. A teaching away in the closest prior art is strong evidence of invention.

Further or alternatively, Hong does not disclose a method or apparatus that has hardening steps prior to machining. Further or alternatively, Hong does not disclose a method or apparatus in which no finishing steps for the machined workpiece are necessary, and/or an apparatus that can produce a workpiece having equal to or lower surface roughness than the theoretical limit. Therefore, Hong does not disclose all the elements of Applicant’s claimed inventions of claims 1-3, 5-9, 15-22, 24, 26-30, 33, 34, 37, 38, 42, 43, 45-49 and 51. Hong, therefore, is not a proper §102 reference. Withdrawal of this rejection is respectfully requested.

Claims 1-4, 7-8, 15-22, 24-30, 34, 35, 37, 38, 42, 43 45-49 and 51 were rejected under 35 USC 102(b) as being anticipated by Zurecki (WO02-096598). The Office Action states:

“Applicants’ earlier PCT discloses a machining process which sprays liquid cryogen on the intersection of the workpiece and the tool. This is disclosed to make the tool harder and stronger. Since applicant’s earlier method is the same as applicant’s currently claimed method, the workpieces are seen to have the same properties. This is especially true for claims 16 -22 which are product by process claims. Since the process of applicant’s earlier publication is the same as applicant’s current method, the products produced thereby are seen as having the same properties. One of ordinary skill in the art would be led to use applicants’ earlier method to prolong the life of the tool involved. In so doing, the workpieces produced by the two processes will be inherently have the same properties as they process the workpieces the same way.”

Zurecki does not disclose a machining process or apparatus in which the cryogenic fluid jets at at least a portion of the tool at an impingement angle (α) greater than about 30° and less than about 90°, and then said cryogenic fluid impinges the workpiece at a spread angle (β). As shown in Figure 1 of Zurecki, the jet of cryogenic fluid hits the tool and evaporates. Zurecki teaches that the jet can be expanded as shown in Figures 2A and 2B, and described at page 10, lines 14-17, but that is not Applicants’ claimed method and apparatus. Zurecki’s cryogenic jet described and shown in those figures expands toward the workpiece, it does not impinge the tool at an angle greater than about 30° and then impinge the workpiece. The impingement angle is important to the present invention to provide for sufficient cooling of the tool to maintain its hardness, when machining a workpiece with

increased hardness in which the workpiece is hardened during the machining or was hardened in a process or by the apparatus prior to machining.

Further or alternatively, Zurecki does not disclose a method or apparatus that has hardening steps prior to machining. Further or alternatively, Zurecki does not disclose a method or apparatus in which no finishing steps for the machined workpiece are necessary, and/or an apparatus that can produce a workpiece having equal to or lower surface roughness than the theoretical limit. Therefore, Zurecki does not disclose all the elements of Applicant's claimed inventions of claims 1-3, 7-8, 15-22, 24, 26-30, 34, 35, 37, 38, 42, 43 45-49 and 51. Zurecki is an improper 102 reference. Withdrawal of this rejection is respectfully requested.

Claims 1-3, 7, 8, 15-30, 34, 35 and 42-54 are rejected under 35 U.S.C. §102(b) as being anticipated by Hong (5,901,623). The Office Action states:

"Hong discloses spraying cryogen onto a workpiece at the site where the tool meets the workpiece. Lines 60-62 of column 1 state that the material gets harder. Lines 63 and 64 of column 9 state that the surface of the workpiece is improved, this is seen as improving the surface integrity of the workpiece during the shaping. In regard to claims 8 and 35, the cryogen is seen as performing heat treatment on the piece. Since Hong's method is the same as applicant's claimed method, the workpieces are seen to have the same properties. This is especially true for claims 16-22 which are product by process claims. Since the process of Hong is the same as applicant's, the products produced thereby are seen as having the same properties. In regard to claims 25, 27, 52 and 54, Hong is seen to eliminate the need for cleaning the piece. Claims 23, 44, 48 and 50 are also seen as product by process claims. While the reference may be silent as to the characteristics being claimed, these characteristics are seen as inherent as the two processes (Hong's and applicants') are the same."

Hong does not disclose a machining process or apparatus in which the cryogenic fluid jets at at least a portion of the tool at an impingement angle (α) greater than about 30° and less than about 90°. As shown in the Figures of Hong, the cryogenic fluid impinges the tool at 0°, and does not contact the workpiece. Hong discloses that the cryogenic liquid should not contact the workpiece at col. 3, line 48-49. Therefore, Hong does not disclose Applicants' invention and actually teaches away from it.

Further or alternatively, Hong does not disclose a method or apparatus that has hardening steps prior to machining. Further or alternatively, Hong does not disclose a

method or apparatus in which no finishing steps for the machined workpiece are necessary, and/or an apparatus that can produce a workpiece having equal to or lower surface roughness than the theoretical limit. Hong may state that its process provides improved work surface quality and reduction in distortion or dimensional changes, but Hong did not disclose that the workpieces did not need any finishing steps. Therefore, Hong does not disclose all the elements of Applicant's claimed inventions of claims 1-3, 7-8, 15-22, 24, 26-30, 34, 35, 37, 38, 42, 43 45-49 and 51. Hong is an improper 102 reference. Withdrawal of this rejection is respectfully requested.

Claims 1-3, 7, 8, 15-30, 34, 35 and 42-54 were rejected under 35 U.S.C. §102(e) as being anticipated by Kraemer (6,652,200). The Office Action states:

"Kraemer discloses spraying cryogen onto a workpiece at the site where the tool meets the workpiece. This is seen as improving the surface integrity of the workpiece during the shaping the same as applicant's process. In regard to claims 8 and 35, the cryogen is seen as performing heat treatment on the piece. Since Kraemer's method is the same as applicant's claimed method, the workpieces are seen to have the same properties. This is especially true for claims 16-22 which are product by process claims. Since the process of Kraemer is the same as applicant's, the products produced thereby are seen as having the same properties. In regard to claims 25, 27, 52 and 54, Kraemer is seen to eliminate the need for cleaning the piece. Claims 23, 44, 48 and 50 are also seen as product by process claims. While the reference may be silent as to the characteristics being claimed, these characteristics are seen as inherent as the two processes (Kraemer's and applicants') are the same."

Kraemer does not disclose a machining process or apparatus in which the cryogenic fluid jets at at least a portion of the tool at an impingement angle (α) greater than about 30° and less than about 90°. As shown in the Figures of Kraemer, the cryogenic fluid impinges the tool at 0°. Kraemer doesn't disclose the use of a cryogenic fluid as the coolant. Therefore, Kraemer does not disclose Applicants' invention. Claims 8 and 35 were amended to indicate that the heat treatment, etc. occurs prior to forming or shaping the workpiece with the tool. Kraemer fails to disclose treatment prior to forming or shaping the workpiece.

Further or alternatively, Kraemer does not disclose a method or apparatus that has hardening steps prior to machining. Further or alternatively, Kraemer does not disclose a method or apparatus in which no finishing steps for the machined workpiece are necessary, and/or an apparatus that can produce a workpiece having equal to or lower surface

roughness than the theoretical limit. Therefore, Kraemer does not disclose all the elements of Applicant's claimed inventions of claims 1-3, 7-8, 15-22, 24, 26-30, 34, 35, 37, 38, 42, 43 45-49 and 51. Kraemer is an improper 102 reference. Withdrawal of this rejection is respectfully requested.

Claims 1-9, 15-36 and 42-54 are rejected under 35 U.S.C. §102(b) as being anticipated by Dudley (3,971,114). The Office Action states:

"Dudley discloses spraying cryogen onto a workpiece at the site where the tool meets the workpiece at an angle to avoid any chips. Line 38 of column 4 states that the surface of the surface of the workpiece is improved. This is seen as improving the surface integrity of the workpiece during the shaping. In regard to claims 8 and 35, the cryogen is seen as performing heat treatment on the piece. Since Dudley's method is the same as applicant's claimed method, the workpieces are seen to have the same properties. This is especially true for claims 16 – 22 which are product by process claims. Since the process of Dudley is the same as applicant's, the products produced thereby are seen as having the same properties. In regard to claims 25, 27, 52 and 54, Dudley is seen to eliminate the need for cleaning the piece. Claims 23, 44, 48 and 50 are also seen as product by process claims. While the reference may be silent as to the characteristics being claimed, these characteristics are seen as inherent as the two processes (Dudley's and applicant's) are the same. The figures of Dudley show the impingement angle to be within applicants' claimed range. The spread angle is seen as between 0 and 180 degrees as a 0 degree spread angle is perfectly straight (any pressurized fluid coming from a nozzle will spread lightly), and a 180 degree spread angle requires the flow to return back to the nozzle.

Dudley does not disclose a machining process or apparatus in which the cryogenic fluid jets at at least a portion of the tool at an impingement angle (α) greater than about 30° and less than about 90°. As shown in the Figures of Dudley, the cryogenic fluid exits toward the workpiece or through a porous part of the tool, or parallel to the surface of the tool. There is no disclosure of jetting the cryogenic fluid at at least a portion of the tool. Therefore, Dudley does not disclose Applicants' invention. Claims 8 and 35 were amended to indicate that the heat treatment, etc. occurs prior to forming or shaping the workpiece with the tool. Dudley fails to disclose treatment prior to forming or shaping the workpiece.

Further or alternatively, Dudley does not disclose a method or apparatus that has hardening steps prior to machining. Further or alternatively, Dudley does not disclose a method or apparatus in which no finishing steps for the machined workpiece are necessary,

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and/or an apparatus that can produce a workpiece having equal to or lower surface roughness than the theoretical limit. Therefore, Dudley does not disclose all the elements of Applicant's claimed inventions of claims 1-3, 7-8, 15-22, 24, 26-30, 34, 35, 37, 38, 42, 43 45-49 and 51. Dudley is an improper §102 reference. Withdrawal of this rejection is respectfully requested.

It is presently believed that claims 1-3, 6-24, 26-30, 33-51, 53-60 which includes already allowed claims 10-14, 37-41 and 55-60 are in condition for allowance. It is respectfully requested that all the claims be allowed to issue in a patent. If there are any remaining issues, the Examiner is invited to contact the Applicants' attorney at the number below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'ABK', is written over a horizontal line.

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